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QUARTERLY REPORT

GTI PROJECT NUMBER 21078

Landfill and Wastewater Treatment RNG Chemical and Physical Profiling: Increasing the Database Set

DOT Prj# 351

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Table of Contents

List of Tables

Table of Figures

Project Objective

The objective of this project is to continue the development of a draft guidance document for the safe introduction of renewable gas into natural gas pipelines. This project will build upon previous studies executed by GTI to further characterize and understand the chemical and biological composition of fully upgraded renewable gas. Gas samples (with an emphasis on post-clean up) will be collected from landfills and waste water treatment facilities and subjected to quantitative analytical chemical and biological tests to measure the concentration of target species. The focus is on samples from facilities currently producing high BTU renewable gas. The two criteria for target species are that they (1) are likely to be in the product gas and (2) have potential to impact pipeline integrity or end use applications. The analytical results obtained from the testing program will be combined with past data and used to report most probable concentrations for those constituents found to be present in renewable gas. The results of this study are not intended to endorse any specific clean up technologies or create national standards for concentration limits for constituents of concern.

Activities/Deliverables Completed this Quarter

The following activities continued this quarter.

Task 1 – Laboratory Testing and Analysis of Biogas/RNG

- Collect processed biomethane samples from the selected landfills and wastewater treatment facilities.
- Analyze the collected samples in the laboratory for the finalized list of constituents.
- Summarize the results of the comparative analysis.

Activities on the remaining project tasks are dependent upon the results from Task 1 and will begin immediately upon completion of Task 1. The final Task 1 Report is due on November 30, 2011.

Technical Status

This project's focus is on the sampling and analysis of processed biogas in order to validate the introduction of landfill- and WWTP-derived renewable gas into natural gas pipelines. Considerable background work was completed in a separate project to determine the three most relevant gas cleanup technologies. The three selected processes are:

- Physical Solvent
- PSA (pressure swing adsorption)
- Gas Separation Membrane

While the gas cleanup technologies are divided into the three categories based on their CO_2 removal technology, these systems utilize multiple unit operations designed to remove other components such as oxygen and water. These add-on units are located either upstream or downstream from the main cleanup system. The specific gas cleanup system will be documented for each site sampled.

Representatives from the High-BTU group at the Solid Waste Association of North America (SWANA) assisted in obtaining access agreements with candidate landfills. The sites vary across the continental United States. To date seven landfill access agreements have been granted, and we are very close to agreement on an eighth. GTI is separately contacting four WWTP facilities with access agreements still under negotiation. The names of the facilities are being kept confidential, as per the agreements with the landfill/wastewater treatment operators.

The list of constituents to be analyzed in this project was divided into two categories, those with specific natural gas tariff limits, and those constituents that are known to be present in processed biomethane, or are of interest, due to potential breakthrough because of their presence in untreated biogas. The finalized list of constituents to be analyzed in this project is described as follows.

- Analytes with Known Natural Gas Tariff Limits
  - Major hydrocarbons (C_1-C_6)
  - Major and Minor Non-Hydrocarbons
    - Carbon dioxide, nitrogen, oxygen, etc.

    - Sulfur Compounds
        - H_2S, odorants, and other naturally occurring organic sulfur compounds
    - Mercury

- Analytes Known to be Present or are of Interest
    - Halocarbons
    - Volatile organics
        - BTEX, and certain aldehydes, ketones, VOCs and SVOCs
    - Siloxanes
    - Other elements
        - Metals and other elements such as As, Bi, and Sb.
    - Ammonia
    - Bacteria related to Microbial Induced Corrosion (MIC)

Samples have been collected from six different landfills over the first two quarters. Two landfills were collected a second time to provide for some seasonal variation, for a total of eight samples. All analyses were completed for the four landfills. The remaining landfill samples were collected in March and the analytical and biological testing is scheduled to be finished in mid April.

The sampling efforts were extensive and samples were acquired as per the QAP and standard sampling protocols set forth in a previous DOT project (DTPH56-08-T-000018, "Pipeline Quality Biogas: Guidance Document for Dairy Waste, Wastewater Treatment Sludge and Landfill Conversion" - WPS #348). Trained personnel collected samples using identical sample collection equipment and sampling conditions. Samples were shipped back to GTI within all approved holding time allotments. Samples were collected in triplicate to allow for statistical comparisons and conclusions to be drawn from the data. They were analyzed promptly, using approved and reported methods, within specified hold times. Thus far, the gas collected and analyzed is clean with only minor trace constituents.

The complete database of analytical results will be reported with the final Task 1 report.

Business Status

Expenditure summary through 3/15/2011 (see table note below):

Table 1. Expenditure and Work Summary

Task No./Name	Federal Obligations Current Budget	Federal Expense this Quarter	Federal Expense To Date	Cost Share Obligations Current Budget	Cost Share Expense this Quarter	Cost Share Expense To Date	% Task Work Completed
1. Laboratory Testing & Analysis of Biogas/RN	$283,888	$12,769	$39,311	$0	$0	$0	24
2. Data Compilation / Final Report	$70,871	$0	$0	$334,716	$50,556.00	$108,838	0
3. Update the Guidance Document	$40,968	$0	$0	$0	$0.00	$0	0
4. Project Management	$60, 585	$2,699	$4,107	$121,611	$14,164.00	$48,007	42
Total	$456, 312	$15,378	$43,418	$456,326	$64,720	$156,845	24

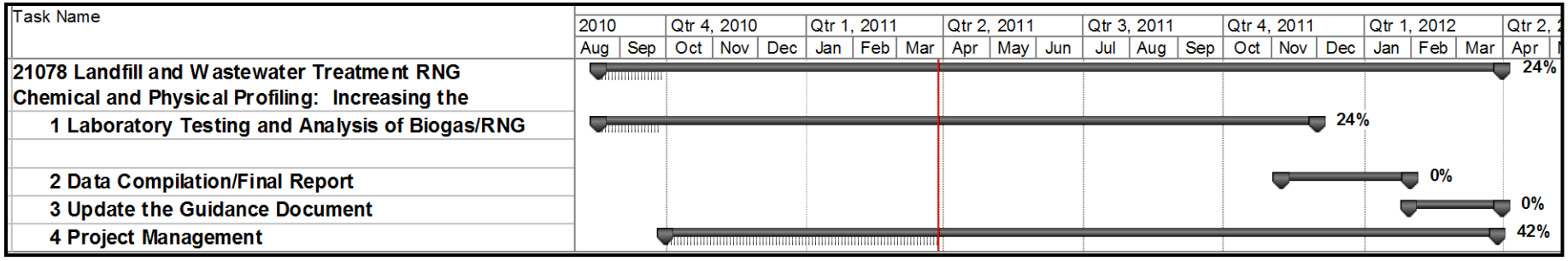
Notes:

1. The above figures are estimates. Actual expenditures up to the end of the reporting period will be submitted by GTI's Accounting Department to DOT/PHMSA per the project agreement approximately one month after the period.

Schedule

An updated project schedule is shown in Figure 1 below.

Figure 1. Schedule



Payable Milestones

The payable milestones for this quarter are:

- 2nd quarterly report

Issues, Problems, or Challenges

Weather and weather-related travel concerns delayed sampling in January and February. This will not have an impact on the project completion. No other issues, problems, or challenges were found this quarter.

Plans for Future Activity

GTI will continue its sampling efforts at candidate landfills and wastewater treatment sites in order to complete Task 1.

GTI will continue construction of the constituent database in order to simplify the statistical analysis at the end of the project. A statistical software package such as Stat-Ease or PAST (PAleontological STatistics) will be used to generate common statistical, plotting and modeling functions.

GTI will initiate Tasks 2 and 3 in a sequential fashion after Task 1 is completed. All required deliverables and data will be submitted on time.